



Cessation of Injecting Drug Use Among Street-Based Youth

Colin Steensma, Jean-François Boivin, Lucie Blais, and Élise Roy

ABSTRACT *Young injecting drug users (IDUs) are at high risk for a number of negative health outcomes such as hepatitis B, hepatitis C, and human immunodeficiency virus (HIV) infection. However, very little is known about injecting drug-use patterns among this population, particularly with respect to cessation of injection. We sought to identify the factors associated with cessation of injection in a population of young street-based IDUs. A prospective cohort study design was used to assess long-term (≥ 1 year) cessation of drug injection. Data was collected between January 1995 and September 2000 in Montreal, Québec, Canada. Subjects were originally recruited from various street-based outreach programs in Montreal and, for this study, had to have reported injecting drugs within the prior 6 months at baseline or during follow-up and had to have completed at least two semiannual follow-up questionnaires. Cessation incidence rates stratified by duration of injection and adjusted hazard ratios (AdjHRs) were calculated. A Cox proportional hazards regression model was used to identify risk factors independently associated with cessation of drug injection. Of 502 young IDUs, 305 subjects met the inclusion criteria. Cessation of injection for approximately 1 year or more occurred in 119 (39%) of the young IDUs. The incidence of cessation was 32.6/100 person-years but consistently declined as duration of time spent injecting increased. Independent predictors of cessation of injection were currently injecting on a less than monthly or less than weekly basis (HR = 6.4; 95% confidence interval (CI): 3.0–13.6 and HR = 2.4; 95% CI = 1.1–5.3, respectively); currently injecting two or fewer different types of drug (HR = 2.1; 95% CI = 1.1–4.0); currently employed (HR = 1.7; 95% CI = 1.1–2.7); and having at least one parent born outside of Canada (HR = 1.4; 95% CI = 1.1–1.7). Independent predictors of not ceasing injection were currently attending a needle-exchange program (HR = 0.5; 95% CI = 0.3–0.8); and current homelessness (HR = 0.6; 95% CI = 0.4–1.0). The early sharp decline in cessation of drug injection followed by a consistent decrease in this rate suggest difficulties in breaking the habit later on in the drug injecting career. Intensity of drug use and factors which may help to stabilize the social environment of the young IDU may also influence the ability to stop injecting.*

KEYWORDS *Cessation, Injecting drug use, Street youth, Young IDU.*

INTRODUCTION

Injecting drug users (IDUs) have been demonstrated to be at higher risk than the general population for a number of negative health outcomes including drug overdoses^{1–3} and serious infectious complications such as blood-borne infections

Mr. Steensma and Drs. Boivin and Roy are with the Montreal Regional Public Health Department, Montreal, Québec, Canada; Mr. Steensma and Drs. Boivin and Roy are also with the McGill University, Montreal, Québec, Canada; and Dr. Blais is with the Université de Montréal, Montreal, Québec, Canada.

Correspondence: Élise Roy, MD, MSc, Montreal Regional Public Health Department, 1301 Sherbrooke Street East, Montreal, Québec, Canada, H2L 1M3. (E-mail: eroy@santepub-mtl.qc.ca)

caused by hepatitis C virus (HCV),⁴ hepatitis B virus (HBV)⁵ and human immunodeficiency virus (HIV).^{6–8} One particular subgroup of concern is young IDUs, including street-based young IDUs, who have been shown to be at significant risk for many of these outcomes.^{9–16} Injection drug use among street involved youth has also been shown to increase the risk of mortality.¹⁷

However, very little is known about injecting drug-use patterns among young IDUs. Some work done among young street-based injectors suggests that injecting drug use is a very dynamic process, wherein frequent transitions are made between routes of administering drugs, including transitions away from injecting drugs towards either total abstinence of drug use or a noninjection form of use such as smoking, intranasal use.¹⁸ The implications that arise from these transitions are potentially large, particularly those “healthy” transitions away from injecting drug use,^{19,20} as well as cessation of drug use in general.

Aside from studies which addressed factors associated with making a general transition from one route of administration to another without specifying directionality (i.e., towards or away from injection of drugs),^{21–24} there are several studies which have addressed cessation of injecting^{19,20,25–33} or transitions from drug injection to complete abstinence of drug use in general.^{34,35} Some of these studies only reported descriptive characteristics of subjects who ceased injection,^{19,20,25,26,28–30} whereas others primarily investigated a single predictor of cessation such as time spent in a drug treatment program³⁴ or influence of peer networks.³⁵ Furthermore, many of the study populations in these cessation studies lack heterogeneity with respect to certain characteristics such as type of drug injected and drug abuse treatment program attendance status. Most of the cessation studies, mainly conducted in Europe and Australia, only involve an investigation of cessation of heroin injection due to the dominance of this drug in these study populations.^{29,31,32,34,35} This may restrict generalizability to other drug injecting populations with polydrug injecting preferences, such as those found in Montreal where both cocaine and heroin are often used by IDUs on a regular basis. Similarly, most of the study populations were drawn from drug treatment programs^{29,31,32,34} that also do not accurately reflect the general IDU population. Finally, the average age in these IDU study populations is often over 30 years, providing very little available information regarding younger injectors. This is problematic, given that early interventions with drug injectors provide a strong potential for effective prevention of the serious social and health consequences related to injecting drug use.

This study proposes to estimate the likelihood of stopping injection as a function of time spent injecting and to assess factors associated with a cessation of injecting drug use in a cohort of young street-based IDUs.

METHODS

Study Population

Subjects for this study were drawn from the Montreal Street Youth Cohort study (MSYC), which started in January 1995 and continued with semiannual follow-up of subjects until September 2000. In summary, this prospective cohort study was initiated in Montreal, Canada, to determine the prevalence and incidence of HIV infection and associated risk behaviours among street youth. Criteria for entry in the MSYC were chosen to capture as much as possible the whole spectrum of street

youth in Montreal. These criteria were being “street active,” between 14 and 25 years of age, English or French speaking, and able to provide informed consent and complete a questionnaire. Youth were considered “street active” if they had, in the last year, either regularly used the services of street youth agencies or been without a place to sleep more than once. These agencies included shelters, drop-in centres, outreach vans, and other facilities offering free-of-charge outreach services such as short-term housing, food banks, and references for and accompaniment to diverse social and health services.

Subject recruitment was ongoing for the duration of the MSYC. Study interviewers recruited participants through regular visits to all 18 major street youth agencies in Montreal. Frequency of visits was established according to the number of youth served by each agency and ranged from twice a week to once a month. Youth agreeing to participate were given an appointment for their interview at our study office located in the downtown area where most street youth hang out. Each interview included signing of the consent form; collection of contact information; completion of a 45-minute interviewer-administered questionnaire covering socio-demographic characteristics, alcohol and drug use, and sexual behaviours; and collection of two samples of gingival exudate for HIV antibody testing.¹⁶ An identifying code permitted the linking of successive interviews for a given subject. Participants received a financial compensation (CAD \$20) for each visit. Original approval was provided by the Human Subjects (Ethics) Committee, Department of Epidemiology and Biostatistics at McGill University and reapprovals by the Institutional Review Board of the Faculty of Medicine at McGill University.

The baseline questionnaire used in this study was previously validated and assessed for acceptability and length (unpublished data). We also studied the test-retest reliability.³⁶ Specifically, questions related to homelessness experiences, sexual behaviours, and drug use behaviours (lifetime, in the last 6 months, and in the last month) were tested and corrected where appropriate.

Cohort participants were followed approximately on a semiannual basis (intervals between interviews could be slightly shorter or longer than 6 months depending on the availability of the youth). Due to the transient nature of street youth life, rigorous follow-up procedures were employed. To facilitate tracing, detailed contact information was collected at each interview. Interviewers contacted participants around the due date of the follow-up visits by telephone, pager, and/or leaving messages with parents, friends, or agencies known to be visited by the youth. The project had a toll-free telephone number to facilitate contact by the subjects. A list of unreachable subjects was sent monthly to various organizations (social security offices, drug treatment centers, probation offices, prisons, and youth rehabilitation centers). These organizations, when authorized by subjects on their consent form, provided current addresses or contact information, or sent messages to participants. Interviewers travelled up to 200 km from Montreal to meet subjects who were unable to come to the study office for their follow-up interview, such as youth who were in a detention or drug treatment centre. Interviewers based in three other major Canadian cities (Québec, Toronto, and Vancouver) also conducted follow-up interviews. Finally, for subjects who could not be met by an interviewer, the questionnaire was completed by phone.

Inclusion in this study subcohort of IDUs (hereafter referred to as the “young IDU” cohort) was limited to subjects who (1) reported having injected drugs at least once within the 6 months before entry into the MSYC study (hereafter referred to as “current” injectors), or (2) reported no injecting experience before entry into the

MSYC study but subsequently reported injecting drugs at least once in at least one follow-up questionnaire (hereafter referred to as “new” injectors). For the current injectors, at least two follow-up questionnaires had to have been completed in addition to the baseline interview. For new injectors, at least two follow-up questionnaires were required after the questionnaire in which they first reported injection. The reason for these requirements regarding number of follow-ups is due to the nature of the dependent variable. We defined cessation of injecting drug use as having answered no to the question “In the last six months did you shoot up [inject] drugs?” at two consecutive questionnaire interviews (i.e., cessation of injecting for approximately 1 year). This means that subjects needed two or more follow-up periods after they reported injecting drugs to have the opportunity to experience the outcome.

Measurement

Predictors of cessation of injecting drug use that were assessed can be grouped into four general categories: sociodemographic, drug injecting/use habits (including alcohol use), nondrug-related risk factors, and potentially stabilizing factors which may enable an IDU-free lifestyle. Most of these predictors were measured on a time-dependent basis, meaning that values were assessed at baseline and reassessed at each follow-up questionnaire and were either based on the 6 months or 1 month preceding the interview. These time-dependent predictors were either irreversible, meaning that their value could change from no to yes only once, or reversible, meaning that their value could change at each interview. Fixed predictors were measured once, at baseline, and their value did not vary thereafter.

Sociodemographic predictors were sex and ethnic background, which was defined as having at least one parent who was born outside of Canada or not. Drug injecting habits (treated as reversible predictors except for first injected drug) included drug most often injected, drug injected at first episode (each of these two predictors had heroin as the reference category), frequency of injecting, number of drugs being injected, and having friends who inject. Drug use habits (treated as reversible predictors) were the number of different drugs used (any route of administration) and excessive drinking (i.e., an average consumption of six or more drinks per sitting in the previous month). Nondrug-related risk factors included prostitution (as a source of income as well as any experience of exchanging sex for gifts or money, both treated as time-dependent irreversible predictors), homelessness (age of first homeless episode and as a time-dependent reversible predictor), history of incarceration (for those 18 or older, treated as time-dependent irreversible), and self-perceived risk of contracting HIV (reversible). Finally, potential stabilizing factors consisted of drug abuse treatment program attendance (irreversible), use of a needle-exchange program (reversible), and measures of current employment and school attendance (both treated as reversible predictors). Prostitution, incarceration, and drug treatment program experiences were treated as irreversible factors, because they are seen to be significant singular events in the youths’ lives, whereas homelessness and needle-exchange program use are much less stable phenomena which need to be observed on multiple occasions. Time-dependent predictors were all measured within the previous 6 months, with the exception of frequency of injection, number of drugs used, and excessive drinking, which were all measured within the previous month. Information for the drug abuse treatment predictor was missing at one questionnaire period for three subjects, and thus the information from the preceding questionnaire was used.

Statistical Analysis

Means and proportions were calculated at entry into the young IDU study for the risk factors outlined above, as well as for characteristics such as age at entry into the young IDU study and duration of injecting drug use (in years) before entry into the young IDU study. In addition to calculating the proportion of subjects who ceased injecting for at least two consecutive follow-up questionnaires, the stability of this cessation was tested by determining the proportion of those who ceased injecting after two consecutive questionnaires who also stopped injecting after four questionnaires (i.e., for approximately 2 years). A comparison of stopping injecting versus abstaining from drug use altogether was also made by calculating the proportion of those ceasing injecting drugs after two consecutive semiannual questionnaires who also stopped using heroin and cocaine (the drugs used most often by 97% of subjects) in that same time period.

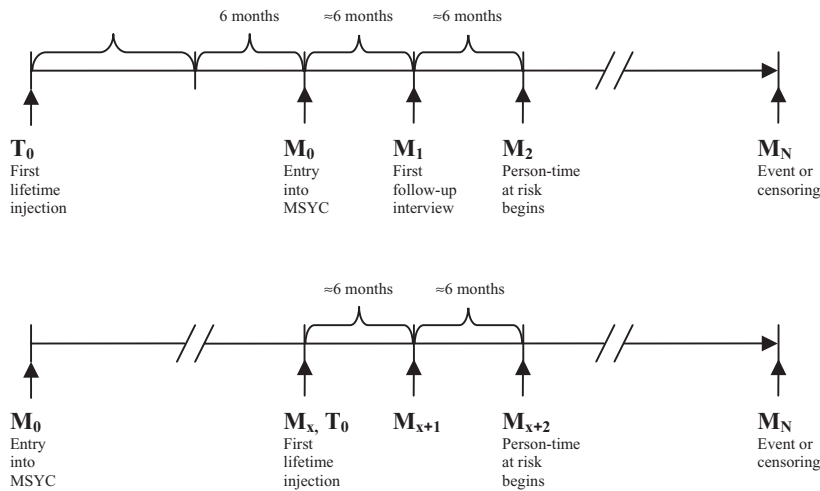
The time axis in this study (i.e., time to cessation of injection) was duration of injection and was measured as the total number of days from first lifetime episode of injection (year and either mid-point of month or season of first injection, as reported by the subject) until date of cessation (event) or date of censoring. Date of cessation was the date of the second questionnaire at which the subject reported not having had injected in the previous 6 months. Date of censoring was the date of the last questionnaire completed before end of follow-up in the MSYC (i.e., death, loss to follow-up, age of the subject exceeded 29 years old, the subject ceased to meet the definition of “street based,” or end of the MSYC study).

Because the current injectors were already injecting before study entry, this presents a situation in which delayed entry (or left truncation) must be taken into account. Furthermore, entry can only occur once the subject has accrued enough follow-up time to have been able to experience the event, that is, at least two follow-up questionnaires (approximately 1 year). Subjects who experienced the event at the same time as this entry date (e.g., those who reported injecting on the baseline questionnaire and reported not injecting on the two subsequent follow-up questionnaires) contributed one day in the analysis. See Figure for a more detailed description of the time at risk and event definitions.

Incidence rates of cessation of injecting drug use were calculated by dividing the number of events by the total number of person-years at risk. This rate was also stratified by duration of injection. Significance of the rates was assessed using 95% confidence intervals (CIs) derived from the Poisson distribution.

A Cox proportional hazards regression model including both time-dependent and nontime-dependent variables was used to identify the predictors of cessation of injection. This model took into account delayed entry times in the model for the current injectors. Crude and adjusted hazard ratios (AdjHRs) with 95% CIs were estimated. The exposure was measured 365 days before the index date (i.e., approximately two questionnaire periods). The index date was defined as time of event (see above in this section) or the corresponding time for all other subjects still at risk in the young IDU cohort at that time.

The multivariate models were chosen using a backward selection procedure in which all predictors that were significant at the $P < .20$ level when tested individually were included in a model and subsequently removed one by one. Those predictors which led to a significant increase in deviance ($P < .05$) when removed from a multivariate model were kept in the final model, whereas the others were dropped. Other predictors which had not been found significant when tested individually were added to the multivariate model at the end of the backward procedure and the



The time axis, duration of injecting, begins at first lifetime injection (T_0) and ends with an injecting drug use cessation event or with censoring (M_N ; see Methods section).

Person-time at risk of cessation of injecting drug use, which is used for rate calculations, begins at M_2 for current injectors and at M_{x+2} for new injectors. If the youth has a cessation event (M_N) at this particular interval, he/she will contribute one day of time at risk in the rate calculations. Time at risk cannot begin before M_2 (current injectors) or M_{x+2} (new injectors) because the youth has not had enough time to experience the cessation event (report of no drug injection for two consecutive follow-up interviews). Inclusion of time at risk before M_2 or M_{x+2} respectively would lead to a biased estimate of incidence as described by Rothman and Greenland as 'immortal person-time' (Rothman KJ, Greenland S. Cohort studies. In: Rothman KJ, Greenland S. eds. Modern Epidemiology. Philadelphia: Lippincott-Raven, 1998;79-92.).

FIGURE. Illustration of temporal definitions. (a) Current injectors (youth already injecting drugs at entry into MSYC). (b) New injectors (youth starting to inject drugs after entry into MSYC).

change in deviance was assessed. Variables which led to a substantial change in the point estimates of the other variables when removed from the model were considered as confounders and were also kept in the final model. Interaction terms based on presumed effect modifiers were also entered into the model. Interactions tested were sex and having friends who inject, sex and type of drug injected, and needle-exchange program use and frequency of injecting. Finally, verification was made of residuals, goodness-of-fit, and the proportionality assumption for final models.

RESULTS

There were 502 subjects who had either injected drugs within the previous 6 months at baseline for the MSYC or started to inject during follow-up and had also entered the cohort at least 1 year before the MSYC study was completed. Of these 502, 305 answered at least two follow-up questionnaires subsequent to their first report of injecting, constituting the study population for the young IDU cohort. Furthermore, out of these 305 injectors, 57 were new injectors during follow-up in the MSYC, whereas the other 248 had been injecting drugs in the 6 months preceding entry into the MSYC. Among those youth already injecting drugs at baseline,

the mean duration of injection before entry into the young IDU cohort for all subjects was 2.9 years [standard deviation (SD) = 2.5; range from 0.1 to 14.7 years].

Baseline characteristics, taken at entry into the young IDU cohort are reported in Table 1. Thirty-nine percent (120) of the subjects were female, whereas the mean age at entry into the subcohort of injectors was 20 years old (SD = 2.5; range from 14.1 to 25.7 years old). There were 43 youth (14%) who reported having at least one parent born outside of Canada. The drug most often injected was heroin for 52% of subjects and cocaine for 42%. Polydrug injecting was quite common, with 55% of subjects reporting current injecting use of more than one type of drug. However, daily injecting drug use was relatively rare when compared to many other IDU study populations: only 18% of IDUs reported injecting on a daily basis within the prior 6 months. A large majority of the young IDUs (83%) had at least one friend who currently injected drugs. Regarding homelessness, more than three quarters (77%) of the subjects were currently without a place to stay and/or dependent on centers and shelters providing services for the homeless. In addition, 89% had experienced their first episode of homelessness before their first episode of injecting drug use. A considerable proportion of subjects had some experience with sex work: 29% had exchanged sex for money or gifts within the last 6 months, whereas 25% reported prostitution as a source of income within the same period. Subjects were generally well acquainted with harm reduction programs: more than half had been in some type of drug detoxification program (62%), and 79% were currently using a needle-exchange program. Finally, 62% of subjects were currently gainfully employed on either an occasional or regular basis.

Of the 305 subjects, 119 (39%) stopped injecting for two consecutive questionnaire periods (i.e., approximately 1 year). A total of 364.9 person-years of time at risk were observed, corresponding to a crude rate of injection cessation of 32.6 per 100 person-years. Of those who stopped injection for two questionnaires and were followed-up for at least four questionnaires, 52% (50 out of 96 subjects) continued to inject no drugs for another two consecutive questionnaires, for a total of approximately 2 years abstaining from injecting. In addition, 77 of the 119 stoppers (65%) reported abstaining entirely from heroin and cocaine use during the time covered by the two consecutive questionnaires. Incidence rates for cessation of injecting drug use stratified by duration of time spent injecting (by year) demonstrated a consistent downward trend in rates of cessation over time (Table 2). During the first year of time at risk in the subcohort, the rate was 112.3/100 person-years. However, subsequent years show a consistent significant decrease in the rate of cessation. The largest drop in this rate occurs after the first year as the rate declines from 112.3/100 person-years to 38.2/100 person-years. These trends also tend to be seen in the subgroups of current and new injectors. This suggests that cessation becomes more difficult as time spent injecting progresses, particularly after the first year or two. Cessation rates stratified by sex and duration of injecting (data not shown) also demonstrated this decreasing trend.

Table 3 summarizes the crude hazard ratios of injection cessation with respect to associated factors. The only significant univariate sociodemographic predictor for cessation was having at least one parent who was born outside of Canada. Crude predictors of injection cessation found among drug injecting and drug use factors were currently injecting cocaine the most frequently, cocaine as first drug ever injected, not having injected within the last month, having injected on a less than weekly basis on average within the last month, currently injecting two or fewer different types of drugs, not currently having any friends who inject, and using two

TABLE 1. Subject characteristics at entry into the young injection drug user (IDU) cohort (N = 305)

Characteristics and behaviours	Number of youth	Proportion (%)
Sociodemographic risk factors		
Female	120	39
Had at least one parent born outside of Canada	43*	14
Drug injecting-related risk factors		
Drug most often injected (in last 6 months)		
Cocaine	129	42
Heroin	159	52
Speedball	3	1
Phencyclidine (PCP)	8	3
Alcohol	1	<1
Other	5	2
Number of different drugs injected (in last 6 months)		
1	138	45
2	80	26
3	66	22
4–7	21	7
Frequency of injecting (in last month)		
Not in the last month	98	32
Less than weekly	87	29
Weekly but less than daily	66	22
Daily or more	54	18
Drug first injected		
Cocaine	135*	45
Heroin	132	44
Speedball	1	<1
PCP	17	6
Other	15	5
Had friends who currently inject (in last 6 months)	250	83
Drug use-related risk factors		
Number of different drugs used, any route of administration (in last month)†		
0	17	6
1	48	16
2	72	24
3	82	27
4	46	15
5–10	40	13
Average number of alcoholic drinks consumed at once (in last month)		
0	33	11
1	14	5
2–5	97	32
6–10	105	34
>10	56	18
Non-drug related risk factors		
Homeless (in last 6 months)	235	77
≥15 years old at first homeless episode	166	54
Had first homeless episode before first IDU episode	270	89

TABLE 1. Continued

Characteristics and behaviours	Number of youth	Proportion (%)
Exchanged sex for gifts or money (in last 6 months)	87	29
Engaged in prostitution as source of income (in last 6 months)	75	25
Had at least one incarceration experience	79	26
Self-perceived HIV risk higher than others (in last 6 months)	72‡	25
Factors encouraging more stable, IDU-free lifestyle		
Ever been in drug abuse treatment program	188	62
Used needle-exchange program (in last 6 months)	240	79
Employed (in last 6 months)	188	62

*N = 300 due to missing values.

†Crack and cocaine treated as one drug; marijuana excluded.

‡N = 292 due to missing values.

or fewer different types of drug in the last month (excluding marijuana). Other significant crude predictors of injection cessation included being 15 years of age or older at the time of first episode of homelessness and being currently employed. In addition, current use of a needle-exchange program was significantly negatively associated with cessation of injection, meaning that those who had used this service were less likely to stop injecting.

The multivariate model summarized in Table 4 included the following independent predictors of cessation of injecting drug use: not having injected within the last month (AdjHR = 6.4; 95% CI = 3.0–13.6, having injected on a less than weekly basis on average within the last month (AdjHR = 2.4; 95% CI = 1.1–5.3), having injected an average of two or fewer different types of drug in the last 6 months (AdjHR = 2.1; 95% CI = 1.1–3.9), being employed in a regular or occasional job in the last 6 months (AdjHR = 1.7; 95% CI = 1.1–2.7), and having at least one parent born outside of Canada (AdjHR = 1.4; 95% CI = 1.1–1.7). Independent predictors of not ceasing injecting drug use were also observed. These were having experienced homelessness in the last 6 months (AdjHR = 0.6; 95% CI = 0.4–1.0) and having attended a needle-exchange program in the last 6 months (AdjHR = 0.5; 95% CI = 0.3–0.8). No significant interaction terms were observed.

DISCUSSION

Of the few studies which have specifically investigated incidence rates and predictors of cessation of injecting drug use, this was the first to do so using a study population of young IDUs. This study demonstrated that there is a consistent decline in the rate of cessation of injection as time spent injecting increases, including a substantial drop in the rate of cessation very early on in follow-up. This is the first time that such a trend is reported. Given that our cohort was composed of recently initiated IDUs, one possible explanation is that severity of dependence on a drug has an important effect on one's ability to stop injecting. This would be in accordance with a Spanish study³⁷ that found that severity of dependence was significantly lower among heroin users (of any route of administration, including injection) who had been using that drug for less than 5 years. This finding was even stronger among those with less than

TABLE 2. Rates of cessation of injecting drug use

Duration of injecting (years)*	Number censored	Number of events	Person-years	Cessation rate (/100 person-years)	95% confidence intervals
Cessation rates among all injectors					
1-	15	41	36.5	112.3	80.6–152.4
2-	23	22	57.6	38.2	23.9–57.8
3-	26	17	63.6	26.7	15.6–42.8
4-	28	12	54.9	21.8	11.3–38.2
5-	20	16	54.8	29.2	16.7–47.4
6-	26	4	36.3	11.0	3.0–28.2
7-	17	4	17.7	22.6	6.2–57.9
8-	11	0	13.4	0	0–27.5
9-	8	1	6.6	15.2	0.5–55.9
10-	12	2	23.6	8.5	1.0–30.6
Total	186	119	364.9	32.6	26.7–38.5
Cessation rates among current injectors					
1-	1	14	13.8	101.4	55.4–170.2
2-	18	18	46.5	38.7	22.9–61.2
3-	22	15	59.7	25.1	14.1–41.4
4-	28	11	54.2	20.3	10.1–36.3
5-	20	16	54.8	29.2	16.7–47.4
6-	26	4	36.3	11.0	3.0–28.2
7-	17	4	17.7	22.6	6.2–57.9
8-	11	0	13.4	0	0–27.5
9-	8	1	6.6	15.2	0.5–55.9
10-	12	2	23.6	8.5	1.0–30.6
Total	163	85	326.7	26.0	20.5–31.5
Cessation rates among new injectors					
1-	14	27	22.0	122.7	80.9–178.5
2-	5	4	11.1	36.0	9.8–92.3
3-	4	2	3.9	51.3	6.2–185.1
4-	0	1	0.6	166.7	5.0–928.3
Total	23	34	38.3	88.8	59.0–118.6

*Duration of injecting begins at first lifetime injection and ends with an injecting drug use cessation event or with censoring (see *Methods* and *Figure*).

3 years' duration of heroin use. A correlation between severity of dependence and duration of heroin use was also found in a study from the UK.³⁸ There also appears to be such a trend among cocaine users, although results are not as clear as for heroin. A Brazilian study²⁸ found a significant association between longer duration of cocaine use and transition in route of cocaine administration (virtually all transitions in this study were from snorting cocaine into more addictive routes of administration, namely, smoking (mostly crack) and injecting). This factor was not kept in the multivariate model reported by these authors, although younger age at cocaine initiation (which could be seen as a proxy for duration of use) was retained.

The crude rate of cessation of injecting drug use observed in our study was substantially higher than that of the Amsterdam study on methadone maintenance and

TABLE 3. Crude hazard ratios of injection cessation

Predictor	Hazard ratio	p-value
Sociodemographic predictors		
Female	1.0	0.919
Had at least one parent born outside of Canada	1.4	0.008
Drug injecting-related predictors		
Drug most often injected (in last 6 months)		
Heroin	Reference	—
Cocaine	1.6	0.029
Other	1.0	0.972
Number of different drugs injected (in last 6 months)		
≥3	Reference	-
1–2	3.2	<0.001
Frequency of injecting (in last month)		
At least once a week	Reference	—
Less than weekly	3.5	0.002
Not in last month	8.6	<0.0001
Drug first injected		
Heroin	Reference	—
Cocaine	1.6	0.023
Other	1.1	0.718
Did not have friends who currently inject (in last 6 months)	1.6	0.044
Drug use-related predictors		
Number of different drugs used, any route of administration (in last month)*		
≥3	Reference	—
1–2	2.0	<0.001
Average number of alcoholic drinks consumed at once (in last month)		
≥6	Reference	—
2–5	0.8	0.349
0–1	0.9	0.678
Nondrug-related predictors		
Homeless (in last 6 months)	0.9	0.498
≥15 years old at first homeless episode	1.5	0.027
Exchanged sex for gifts or money†	0.7	0.095
Prostitution as source of income†	0.7	0.117
Had at least one incarceration experience†	0.9	0.713
Self-perceived HIV risk higher than others (in last 6 months)	0.8	0.506
Predictors encouraging more stable, IDU-free lifestyle		
Attended drug abuse treatment program†	0.6	0.113
Used needle-exchange program (in last 6 months)	0.5	<0.0001
Employed (in last 6 months)	1.5	0.045

*Crack and cocaine treated as one drug; marijuana excluded.

†Time-dependent irreversible.

cessation, which was the only other study to calculate such a rate.³¹ However, the population used in that study had a mean age of 30 years old at entry, compared to our study population in which mean age at entry was 20 years old. More importantly, the mean duration of injecting drug use at entry into that study was 10.1 years

TABLE 4. Adjusted hazard ratios (AdjHRs) of injection cessation

Predictor	AdjHR	95% confidence interval
At least one parent born outside of Canada	1.4	1.1–1.7
Frequency of injecting (in last month)		
At least once a week	Reference	—
Less than weekly	2.4	1.1–5.3
Not in last month	6.4	3.0–13.6
Number of different drugs injected (in last 6 months)		
≥3	Reference	—
1–2	2.1	1.1–3.9
Used needle-exchange program (in last 6 months)	0.5	0.3–0.8
Employed (in last 6 months)	1.7	1.1–2.7
Homeless (in last 6 months)	0.6	0.4–1.0

versus 2.3 years in our study. One would expect to find that older, long-term injectors are much less likely to stop injecting drugs as compared to younger, short-term IDUs. Indeed, those injectors in our study who had spent 8 or more years injecting had a rate of cessation of 6.9/100 person-years that is comparable to that of the Amsterdam methadone study (4.1/100 person-years).

Several independent predictors of cessation of injecting drug use were also observed in this study. Among sociodemographic factors, having had at least one parent who was born outside of Canada predicted cessation. A similar result was found in the Amsterdam study on population trends in IDU transitions,³² in which being of non-West European ethnicity was a predictor of cessation. Similarly, a British study comparing routes of administration of cocaine found that the proportion of subjects of Afro-Caribbean origin who were injecting was significantly less than that of white subjects.³⁹ It has been hypothesized that this phenomenon could be attributed to cultural and social aversions towards drug injecting⁴⁰ and use of needles in general³² among certain ethnic groups. However, it is difficult for us to make this inference in our own study population, given the small proportion of subjects with a background other than North American or Western European, coupled with the large degree of ethnic heterogeneity within that subset.

We found that injecting drugs on a less frequent basis was predictive of stopping injecting. A similar, strong association was found in the Amsterdam studies: Those in the study of injecting trends were less likely to stop if they were injecting on a daily or greater basis,³² whereas those in the methadone study were over six times as likely to stop if they were less than daily injectors.³¹

Another predictor of cessation was injecting fewer types of drugs. Although this variable was not examined in other cessation studies, there is evidence of a similar phenomenon in severity of dependence studies where users of more than one drug were found to be more severely dependent on heroin.³⁸ Polydrug use was also found to be a predictor of transition into injecting use of amphetamines.²⁶

Other predictors included use of a needle-exchange program, which was negatively associated with cessation. This result was also observed in the two Amsterdam cessation studies in which a lower proportion of needles obtained from a needle-exchange program was predictive of cessation.^{31,32} This phenomenon could have been attributable to the fact that IDUs participating in a needle-exchange program may include a particularly high proportion of injectors whose lifestyle and

pattern of drug use are more erratic,⁴¹ therefore making them less likely to stop injecting. Regardless of possible explanations for this result, it should be stressed that the variable used in our study was a rather crude indicator of needle-exchange program use (e.g., no measure of *degree* of needle-exchange program use) taken from a study that was not specifically designed to measure effectiveness of needle-exchange programs and as such, should not be used to make inferences in this regard.

Employment was also a factor in stopping injection, following the Australian study in which being employed was independently associated with a transition to noninjecting benzodiazepine use.²⁷ A stable home life was also found to be influential in cessation; those who were homeless were found to be less likely to stop. There is no data available on the relationship between homelessness and cessation of drug injection in the literature. However, some researchers have suggested that a low level of general social integration of drug users may increase their likelihood of being IDUs.^{42,43} Our findings are consistent with these observations.

Although we could not find a significant association between drug detoxification program attendance and IDU cessation, the hazard ratio suggested a negative effect on cessation that differed from results found in other related studies.^{29,34} A phenomenon similar to that discussed above regarding needle-exchange programs may explain the observation, that is, being in treatment is a marker for more intensive injecting drug use. A study of IDU initiation from New York found that previous drug treatment was a predictor of starting to inject.⁴⁴ However, it is difficult to draw conclusions from our study, because it is not an evaluation study of detoxification programs. In addition, we lack specific information on treatment status indicators such as duration of attendance, and we were not able to stratify for specific treatment modalities that were represented exclusively in the studies mentioned above.^{29,34}

Our study had some limitations including a potential bias in the selection of subjects. The loss of subjects before they had completed at least two follow-up questionnaires might have biased the results if, for example, loss to follow-up was related to severe injecting drug addiction that may have hindered daily functioning, including the youth's capacity to maintain study participation. However, we used rigorous follow-up procedures that resulted in a very low rate of attrition (3.8 per 100 person-years among all IDUs in the MSYC). Nevertheless, we compared young IDUs excluded from the study with MSYC participants at baseline. Young IDUs who were not included in the study were comparable to study participants at baseline with respect to having had at least one parent born outside of Canada, current homelessness, and current employment. Young IDUs excluded from the study also did not differ significantly from study participants already injecting at study entry with respect to duration of drug injection before baseline. However, excluded young IDUs had a lower proportion of current weekly and daily injectors, as well as a lower proportion of current use of three or more injected drugs, and a lower proportion of current needle-exchange program use.

Issues concerning biases related to self-report and recall, as well as generalizability in the MSYC, have been addressed elsewhere.⁴⁵ One review of the IDU literature found self-report among IDUs to be reliable and valid.⁴⁶ Regarding generalizability, cohort participants should be representative of the larger Montreal street youth population, given that recruitment was conducted in all major street youth organizations and that the refusal rate as well as the attrition rate were low. Only approximately 12% of offers to participate in the MSYC were refused. However, because

the study population was drawn from street-based youth, it may not be possible to generalize our findings to all young IDUs. Similarly, inferences for older, longer term IDUs are also uncertain, because our target population was young IDUs. However, as has been demonstrated in the first part of the discussion, many similarities exist between this study and studies on IDU cessation in older populations with respect to factors associated with cessation. It would be useful to follow young IDU populations for a longer period and include analyses of relapse into injecting drug use that could then be compared to similar studies in older populations.³³ Similarly, some injectors may have stopped simply because of their status as experimenters, that is, they had only injected drugs several times in their life and decided, for whatever reason, to stop before they had begun to form a habit. Although the number of experimenters in this study was relatively low (10% of subjects had injected less than six times by the end of follow-up), it is unclear what influence they might have had on the rates of cessation. One other generalizability issue concerns the injecting drug preferences that tend to be more homogeneous in populations other than our own. IDUs in this study reported significant amounts of both heroin and cocaine being injected, which may mean that our results will differ from populations consisting primarily of exclusive heroin or cocaine injectors.

In summary, various predictors of cessation of injecting drug use among young IDUs have now been identified. The high initial rate of IDU cessation was followed by a sharp and generally consistent decline over the subsequent years. One study investigating the longer term patterns of IDU cessation and relapse found that almost three quarters of the study population had at least one cessation event over a 12-year follow-up period.³³ However, only slightly more than a quarter of those ceasing to inject were able to do so without relapse for the duration of the study period. Given that it appears that the longer the period of injection, the less likely the probability of cessation of injection, we believe that our results demonstrate the importance of intervening as early as possible in the career of the IDU to increase the likelihood of success in cessation of injection. Moreover, it appears that the needs of the IDU are different depending on the duration of their injecting career, and this should be taken into consideration when offering harm reduction services to facilitate stable and persistent cessation of injection among all IDUs.

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